

Underground Geothermal System

The City of Fitchburg is committed to building sustainable communities by reducing our community's dependence on fossil fuels.

This geothermal heating and cooling system was installed in 2010 during the construction of the Fitchburg Public Library.



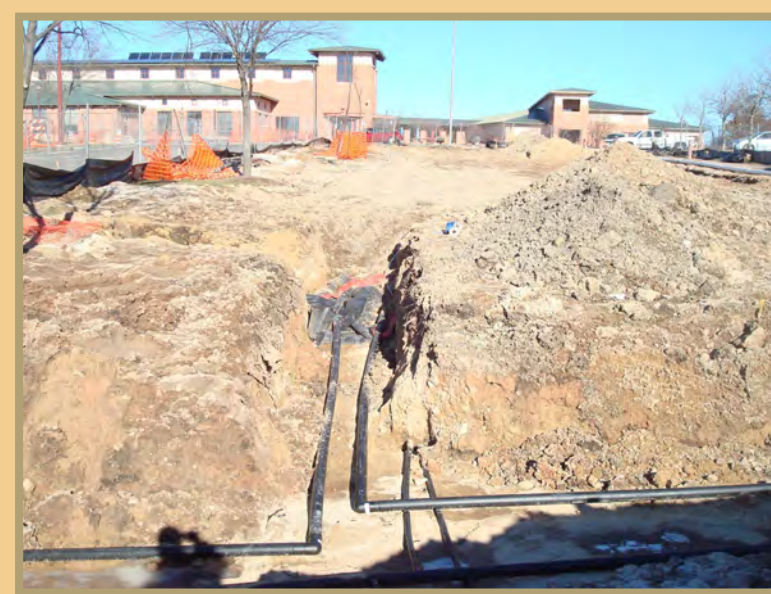
Drilling the bore holes



Horizontal piping, facing east



Facing west



Facing north

Investing in reduced energy consumption

This system will significantly reduce the public library's dependence on local energy utilities.

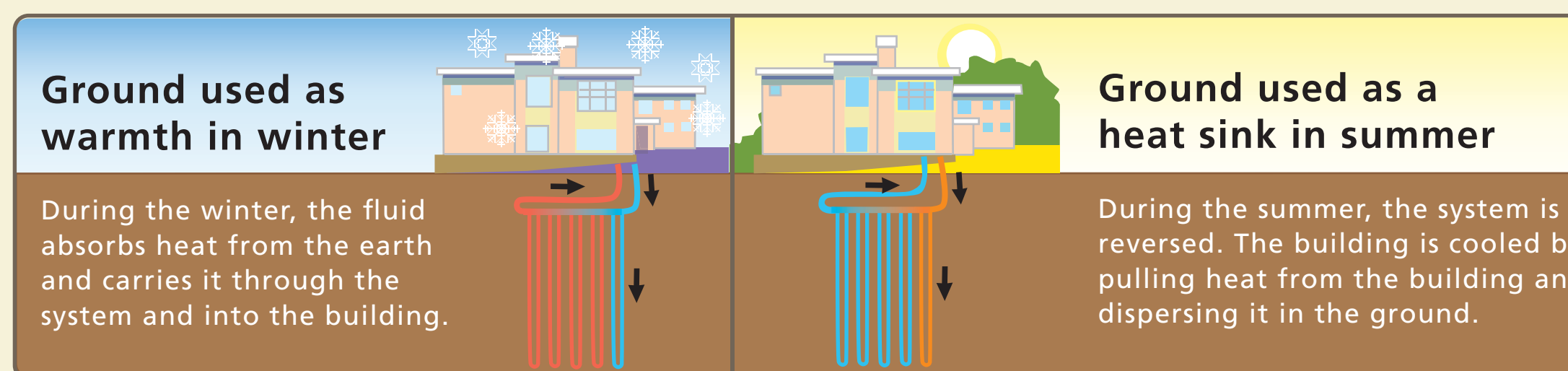
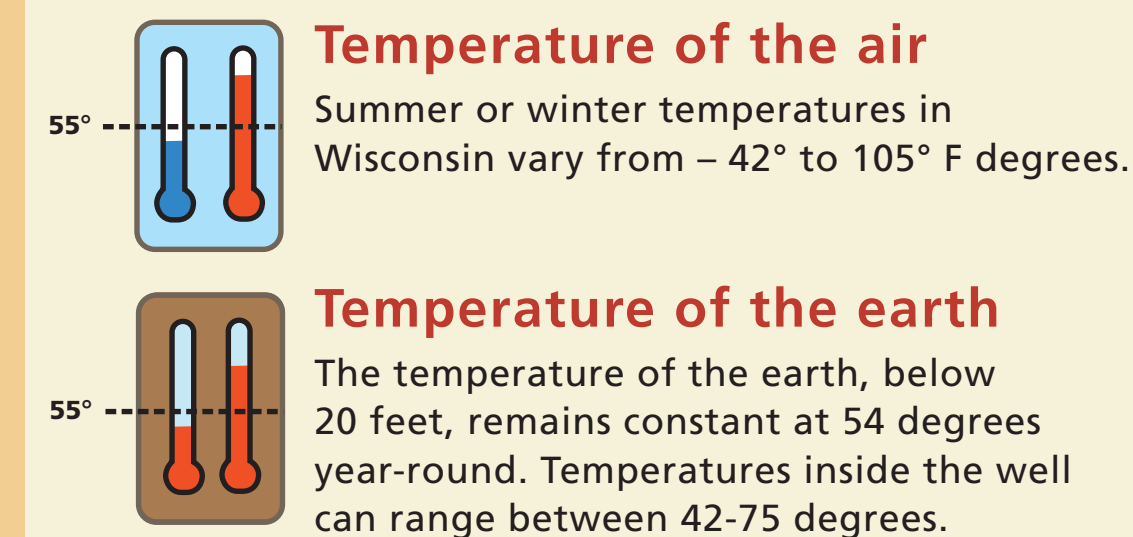
Because the system requires capitol expenditures during installation, the City of Fitchburg anticipates a long-term return on this investment over a 30-year period.

Life-cycle costs and the carbon footprint

Geothermal systems have lower year-to-year operating costs than conventional systems. During the exploratory phase of library planning, this system was modeled, planned and tested for energy efficiency. The study determined the library's energy needs, the life-cycle cost and analyzed the carbon footprint.

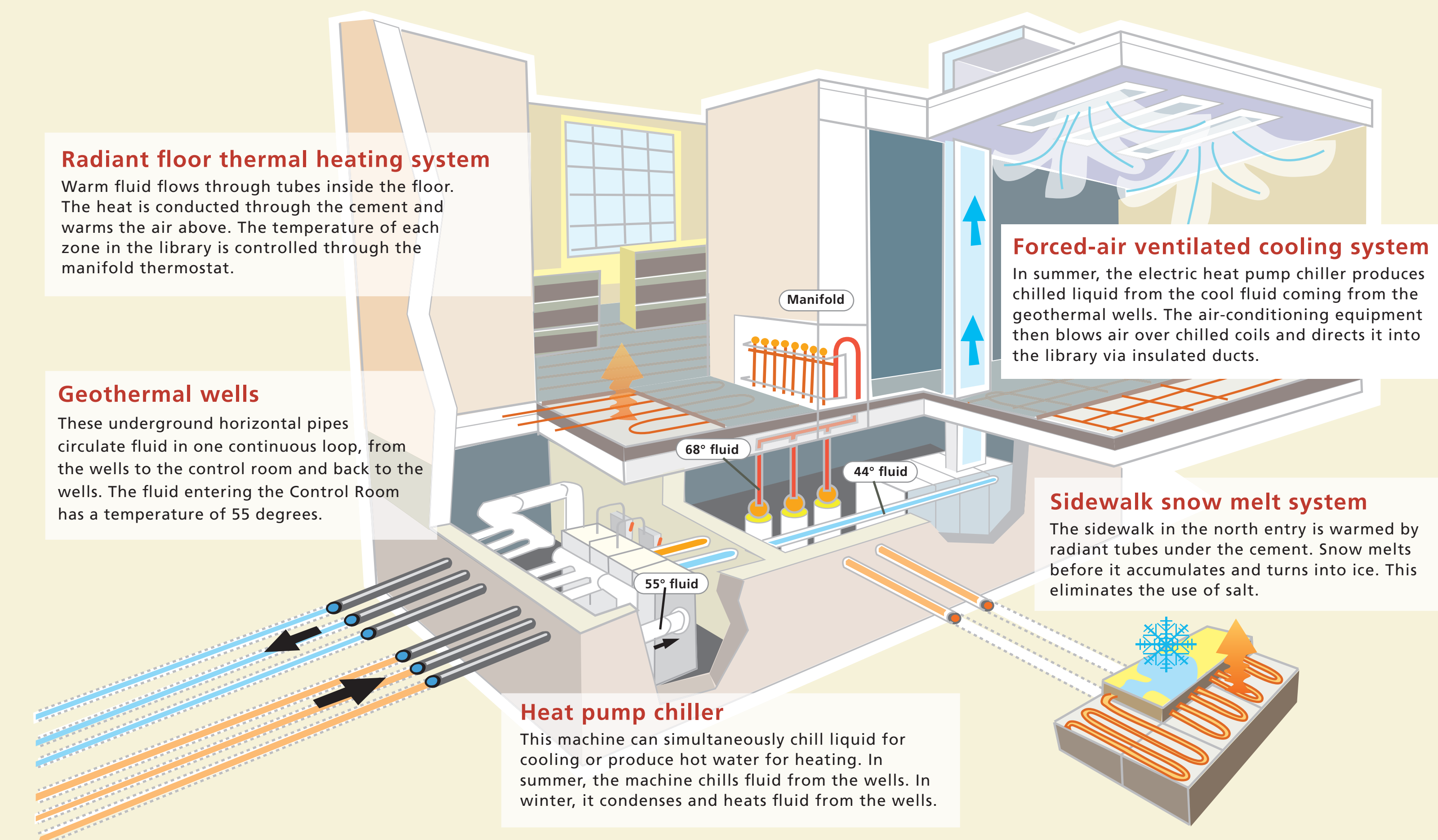
HOW A GROUND-SOURCE HEAT PUMP WORKS

Inside this underground system, liquid colder than 54 degrees is warmed by the surrounding earth, and liquid warmer than 54 degrees is cooled by the surrounding earth.



HOW THE LIBRARY'S GEOTHERMAL SYSTEM WORKS

The Fitchburg Public Library is a high-performance building and it is designed for optimum energy efficiency. The Control Room, located in the basement of the library, contains mechanical equipment that supports the radiant floor heating system, the forced-air ventilated cooling system and the sidewalk warming sytem.



Clean energy from the earth

Below this plaza lies a vertical underground network of sealed plastic piping. The closed loop begins ten feet below the surface and extends almost 400 feet into the earth.

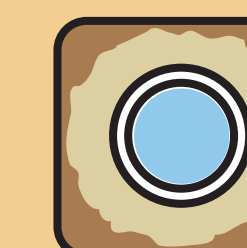
52 vertical closed-loop wells
The wells are spaced in a grid, approximately 15 feet apart. The wells are linked together by horizontal tubes. Six or eight wells are linked together to form a mini-loop.

The underground pipes enter the library here.

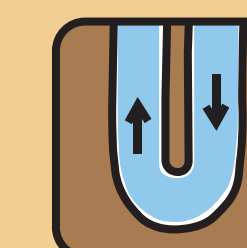
Wellfield circulating-fluid system
This closed loop of piping is filled with a working fluid that is continuously re-circulated through the interlinked plastic pipes.



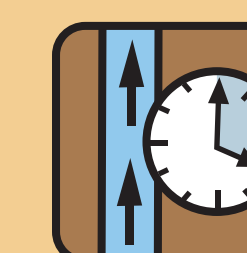
75% water, 25% glycol
This fluid does not freeze. The fluid in the PVC pipe has no contact with the surrounding soil or water.



Thermal exchange
The fluid absorbs thermal heat from the earth through a putty material filled around the pipe bore hole.



U-shaped tubes
At the bottom of the well, the pipe pairs form a U-shape. The liquid flows around the U and then flows up the tube.



Circulation speed
The liquid takes approximately 20 minutes to circulate through each of the six or eight well mini-loops.

38,000 linear feet of pipe
If stretched out, this system would be seven miles long.